

4.2 Sharing of Feeder Links in the Earth-to-Space Direction With the Radionavigation Service in the 15.4 - 15.7 GHz Band

The minimum e.i.r.p. values for total band sharing are quite high and may not be practical for all feeder links for all systems. The values for partial band sharing, particularly for elevation angles above 20 degrees appear reasonable for feeder link Earth-to space emissions. Partial band sharing appears feasible. For this case, the following limitations would apply.

- 1) A minimum Earth station carrier e.i.r.p. of 71 dBW for elevation angles equal to or less than 20 degrees and a necessary bandwidth greater the 3 MHz. For bandwidths equal to or less that 3 MHz, a minimum e.i.r.p. density of 66.2 dB(W/MHz) would apply.
- 2) A minimum Earth station carrier e.i.r.p. of 66 dBW for elevation angles greater than 20 degrees and a necessary bandwidth greater than 3 MHz. For bandwidths equal to or less than 3 MHz, a minimum e.i.r.p. density of 61.2 dB(W/MHz) would apply.
- 3) A maximum radiolocation system average e.i.r.p. of 42 dBW.

4.3 General Comments

As indicated in the CPM95 Report, no studies have been performed on feeder link sharing with radionavigation system in the 15.4-15.7 GHz. In the preceding analyses, quantitative limitations have been developed which would allow sharing without any coordination requirement for the protection of the radionavigation service from satellite emissions and the protection of satellites from radiolocation system emissions. These limitations can be used on a provisional basis pending further study by the Bureau of Radiocommunications.

Coordination will be required on a local basis for interference between feeder link Earth stations and radionavigation stations for both Earth-to-space and space-to-Earth links.

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United States of America

Proposals for Agenda

Proposals for Agenda Items 2.1c and 3d

Regulatory Aspects for Feeder Links for the Mobile-Satellite
Services

Introduction:

In preparation for the WRC-95, the CPM-95 has identified various procedural revisions that would be necessary for non-geostationary mobile-satellite service feeder link networks to share certain frequency bands in the 4 to 8 GHz, 8 to 16 GHz, and 16 to 30 GHz frequency ranges with current and future users of those frequency bands. The United States proposals to modify Articles 28 (S21) and Article 29 (S22) of the simplified international Radio Regulations, contained herein, are to support immediate and actual needs of the mobile-satellite service and are based on the output from the CPM-95 and the recommendation by the VGE to simplify the Radio Regulations.

USA/ /1 MOD

Article 28 (S21.16) § 6 The power flux-density limits at the Earth's surface produced by emissions from a space station, including emissions from a reflecting satellite, for all conditions and all methods of modulation, shall not exceed that limit given in the Table (AR28) below. The limit relates to the power-flux density which would be obtained under assumed free-space propagation conditions and applies to transmission by space stations of the service indicated where the frequency bands are shared with equal rights with the fixed or mobile service unless otherwise stated.

Table [AR28]

Frequency Band	Service	Limit in dB(W/m ²) for angle of arrival above the horizontal plane			Reference Bandwidth
		0°-5°	5°-25°	25°-90°	
<u>6650-7075 MHz</u>	<u>Fixed-satellite (for non-geostationary mobile-satellite feeder links)</u>	<u>-158</u>	<u>-158 + 0.5(φ-5)</u>	<u>-148</u>	<u>4kHz</u>
		<u>-134</u>	<u>-134 + 0.5(φ-5)</u>	<u>-124</u>	<u>1MHz</u>
<u>12.75-13.25 MHz</u>	<u>Fixed-satellite (for non-geostationary mobile-satellite feeder links)</u>	<u>-150</u>	<u>-150 + 0.5(φ-5)</u>	<u>-140</u>	<u>4kHz</u>
		<u>-126</u>	<u>-126 + 0.5(φ-5)</u>	<u>-116</u>	<u>1MHz</u>
<u>15.4-15.65 GHz</u>	<u>Fixed-satellite (for non-geostationary mobile-satellite feeder links)</u>	<u>-111</u>	<u>-111</u>	<u>-111</u>	<u>1MHz</u>

Reason:

MOD No. Article 28 (S21.16) of the simplified Radio Regulations regarding the power flux-density limits for the frequency bands 6650-7075 MHz, 12.75-13.25 GHz, and 15.45 -15.65 GHz would be necessary for shared use of the band by non-geostationary mobile-satellite service feeder links. This table is in the format of the VGE Report.

USA/ /1 ADD

2631A (S22.5A) § 5 In the frequency bands 6650-7075 MHz (space-to-Earth) and 12.75-13.25 GHz (space-to-Earth) where feeder link networks of the mobile-satellite service share with geostationary fixed-satellite networks operating in the Earth-to-space direction of transmission, the maximum power flux-density produced at the geostationary-satellite orbit by the aggregation of all emissions from a non-geostationary mobile-satellite service feeder link satellite constellation shall not exceed -168 dB(W/m²) in any 4 kHz band. These values apply within +/- 5° of the geostationary-satellite orbit.

Reason:

ADD No. 2631A (S22.5A) would provide protection to the geostationary satellite orbit from emissions from non-geostationary satellite networks providing mobile-satellite service feeder links.

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United States of America

Proposals for Agenda Item 2.2

Power Limits for the Earth Stations in the Space Science Services
in the Band 2025 - 2110 MHz

Introduction:

WARC-92 modified the status of the space operation, space research and Earth exploration satellite services in the band 2025 - 2110 MHz from Article 14 to primary. WARC-92 did not, however, specify any e.i.r.p. limits for earth stations in these services. This raised some concern since the band is shared with the fixed and mobile services. Under WRC-95 Agenda Item 2.2, the reference e.i.r.p limits would be considered.

Radio Regulations Article 28 (S21), No. 2541 (S21.8) provides e.i.r.p limits for earth stations in frequency bands between 1 and 15 GHz. Radio Regulation No. 2547 (S21.12) explicitly lists services and associated bands for which the limits apply. The space science services are not listed for the 2025 - 2110 MHz band.

Ad Hoc Joint Working Party 7B/9D (AH JWP 7B/9B) has been established to study various sharing conditions including suitable e.i.r.p limits for the space services earth stations in the 2025 - 2110 MHz band. At the November 1994 meeting of AH JWP 7B/9D it was decided that the power limits given in No. 2541 are appropriate to apply to earth stations operating in the 2025 - 2110 MHz band. The CPM Report to WRC-95 also concluded that the e.i.r.p. limits of earth stations operating in the 2 GHz range should be no more than the existing RR 2541 Limits. The U.S. therefore proposes to apply the limits in No. 2541 to the space services in the 2025 - 2110 MHz band.

ARTICLE 28 (S21)

Section III. Power Limits for Earth Stations

MOD 2547 (5) The limits given in No. 2541 (S21.8)
(S21.12) apply, where applicable, to the services
and frequency bands indicated in Table
[AR27ter] below for transmission by earth
stations where the frequency bands are
shared with equal rights with the fixed or
mobile service:

TABLE [AR27ter]

USA/ /1 MOD

Frequency band	Services
<u>2025 - 2110 MHz</u> 5670 - 5725 MHz (for the countries mentioned in No. S5.454 with respect to the countries mentioned in Nos. S5.453 and S5.455)	Fixed-Satellite Earth Exploration- Satellite Meteorological-Satellite Mobile-Satellite Space Research <u>Space Operation</u>
(Note: Remainder of table unchanged)	

Reason:

To provide power limits for Earth stations in the earth
exploration-satellite, space research, and space operation
services in the 2025 - 2110 MHz band.

United States of America

Proposals for Agenda Item 2.3

13.75-14.0 GHz and Resolution No. 112

Introduction:

Resolution 112 called for studies, with respect to the values given in No. 855A (S5.502) of the Radio Regulations relating to allocations in the band 13.75-14 GHz and to report the outcome at least one year before the next competent conference. ITU-R Task Group 4-4 was formed to perform the necessary studies. This Task Group completed its studies and confirmed the values given in No. 855A (S5.502). Recommendation ITU-R S.1068 was developed and approved by the ITU-R which provides further detail with respect to the sharing of the fixed-satellite service with the radiolocation and radionavigation services.

Resolution 112 also called for studies with respect to the technical compatibility between the primary allocation to the fixed-satellite service (Earth-to-space) and the secondary allocations to the space research and Earth exploration-satellite services. ITU-R Task Group 7-3 was established to study this compatibility taking into account the time frames given in No.855B. Task Group 7-3 developed protection criteria for the secondary services. Task Group 4-4 considered constraints which would apply to the fixed-satellite service to meet these protection criteria within the time frames given in No. 855B. The two Task Groups, in close consultation, developed two companion Recommendations; ITU-R S.1069 and ITU-R SA.1071. These recommendations provide further technical details with respect to the compatibility between the fixed-satellite services and these secondary services.

The CPM Report addresses WRC-95 Agenda Item 2.3 "to review Resolution No. 112 in light of the results of studies carried out in application of that Resolution and take appropriate action". The CPM concluded that all necessary studies have been performed and the results of these studies, including mutually satisfactory criteria, are contained in the above ITU-R Recommendations. The

"appropriate action" with respect to Agenda Item 2.3 is given in the below proposals.

ARTICLE 8 (S5)

USA/ /1

MOD 855A (S5.502)

In the band 13.75-14 GHz, the e.i.r.p. of any emission from an earth station in the fixed-satellite service shall be at least 68 dBW, and should not exceed 85dBW, with a minimum antenna diameter of 4.5 meters. In addition the e.i.r.p., averaged over one second, radiated by a station in the radiolocation ~~or~~ and radionavigation services towards the geostationary orbit shall not exceed 59dBW. ~~These values shall apply subject to review by the CCIR and until they are changed by a future competent world administrative radio conference (see Resolution 112)- (see the latest version of Recommendation ITU-R S.1068 for additional information).~~

Reason:

Now that the Radiocommunications Sector has confirmed the values in RR 855A (S5.502), it is no longer necessary to retain the tentative text. The cited Recommendation contains more detailed information for assessing interference.

USA/ /2

MOD 855B (S5.503)

In the band 13.75-14 GHz geostationary space stations in the space research service, for which information for advance publication has been received by the ~~IFRB~~ Bureau prior to 31 January 1992, shall operate on an equal basis with stations in the fixed-satellite service; after that date new geostationary space stations in the space research service will operate on a secondary basis. ~~Until 1 January 2000, stations in the fixed-satellite service shall not cause harmful interference to non-geostationary space stations in the space research and Earth exploration satellite services, after that date these non-geostationary space stations will operate on a secondary basis in relation to the fixed-satellite service. The e.i.r.p.~~

density of emissions from any earth station in the fixed-satellite service shall not exceed 71 dBW per 6 MHz in the frequency range 13.772-13.778 GHz until those geostationary space stations in the space research service, for which information for advance publication has been received by the Bureau prior to 31 January 1992, cease to operate in this band. Automatic power control may be used to increase the e.i.r.p density above 71dBW to compensate for rain attenuation to the extent that the power flux density at the fixed-satellite space station does not exceed the value resulting from use of 71dBW e.i.r.p. in clear sky conditions.

Reason:

This modification incorporates a "recommends" of the Recommendation ITU-R S.1069 from BR Study Group 4 for the protection of the geostationary data relay satellite transmissions. To clarify the language concerning non-geostationary satellites the second sentence is deleted from this footnote and incorporated into No. 855C with the date changed in accordance with ITU-R S.1069 and ITU-R SA.1071

USA/ /3 ADD
855C (S5.503A)

Until 1 January 2000 (until 1 January 2001 for space borne precipitation radars), stations in the fixed-satellite service shall not cause harmful interference to non-geostationary space stations in the space research and Earth exploration satellite services. After those dates these non-geostationary space stations will operate on a secondary basis in relation to the fixed satellite service. When planning and coordinating networks in the fixed-satellite service in accordance with the provisions of Article 11 (S9) in the band 13.75-14 GHz, account should be taken of the information given in the latest version of Recommendation ITU-R S.1069.

Reason:

To clarify the language concerning non-geostationary satellite, the second sentence was deleted from No. 855B, modified (Based on ITU-R S.1069) and incorporated into this footnote. The second sentence provides a reference to the protected criteria for non-geostationary satellites operating in

the Earth exploration-satellite service contained in the above Recommendations.

USA/ /4 SUP

Resolution No. 112, "Allocation of
Frequencies to the Fixed-Satellite Services in the
Band 13.75-14 GHz".

Reason:

It is no longer necessary to keep Resolution No. 112 as the work envisioned under that Resolution has been completed.

United States of America

Information Document

Sharing in the Band 13.75-14 GHz
CPM 95 Report, Section 3.7.3
Power Flux Density Limits

1. Introduction:

The comments given in Table 15 of the CPM95 Report indicate that the use of the band 13.75-14.0 GHz for mobile-satellite service(MSS) feeder links for space-to-Earth transmissions, i.e., in the opposite direction of the current fixed-satellite service(FSS) allocation for Earth-to-space, would be very limited. Further analysis of the pfd limit given in Table 15 shows that the value of $-162 \text{ dB(W/m}^2\text{/4kHz)}$ should be reduced to $-167 \text{ dB(W/m}^2\text{/4kHz)}$ which would further limit its use. Thus, this band is not considered to be a useful band for space-to Earth feeder links for MSS.

2. Analysis

This band is allocated on a primary basis to the radiolocation (RL) service and in some countries to the radionavigation(RN) service. The notes in Table 15 indicate that a coordination requirement must not be placed on the RL service and that a satellite pfd limit at the Earth's surface of $-162 \text{ dB(W/m}^2\text{/4kHz)}$ is needed to protect that service(see section 3.7.3). This pfd is based on a one dB loss in sensitivity of the radars described in Recommendation ITU-R S. 1068. These radars were designed over 15 years ago for ship borne operation and do not incorporate the latest technologies. In section 3.7.3, it is noted that this pfd limit applies to currently existing RL/RN services in this band but that future equipments could have improved sensitivities and would require lower pfd's for the same protection level. The maximum G/T of these currently existing radars is about 8 dB.

The general expression for the calculation of a pfd limit for this case is;

$$pfd \leq -217.6 + 10 \log B - 20 \log l - G/T + I/N \quad (dB(W/m^2/B)) \quad (1)$$

where: B - bandwidth in Hz
 l - wave length in meters
 G/T - antenna gain/noise temperature in dB
 I/N - allowable interference/noise in dB

Solution of equation (1) for a G/T of 8 dB and an I/N of -5.9 dB (one dB sensitivity loss) results in the pfd limit of -162.2 (-162) dB(W/m²/4kHz).

Both land based and ship borne radars are currently operating in the 15.4-15.7 GHz band with typical G/T's of 13 dB as shown in Table 1. The information in this Table was transmitted to the CPM from Task Group 8-3 but was not included in the CPM Report. Since a G/T of 13 dB should also be readily achievable in the 13.75-14.0 GHz band, the pfd of -162 dB(W/m²/4kHz) should be reduced by 5 dB to -167 dB(W/m²/4kHz) in order to make adequate allowance for improvements in radar receiver sensitivity in the 13.75-14.0 GHz band.

Table 1
 Characteristic of a Radar System

Transmitter Parameters:

Frequency (GHz) :	15.65-16.4
Emission Bandwidth (MHz) :	20
Peak e.i.r.p. (dBW) :	86
Peak TX Power (kW) :	20
Antenna Gain (dBi) :	43
PRF (Hz) :	8,192
Pulse Length (ms) :	0.04
Duty Cycle (%) :	0.0328

Receiver Parameters:

Antenna Gain(dBi) :	43
Typical Noise Figure(dB) :	6.2 to 6.9
Typical Noise Temperature(³ K) :	920 to 1,130
Typical G/T(dB) :	12.5 to 13.4

3. Conclusion

The band 13.75-14 GHz is not a viable band for space-to-Earth feeder links for MSS due to the severe sharing constraints which must be placed on satellite emissions in order to protect the primary Radiolocation and Radionavigation services.

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United States of America

Proposals for Agenda Items 2.1a) and 3.d)

Mobile-Satellite Services Below 1 GHz

Introduction:

The attached U.S. proposals address issues related to mobile-satellite services (MSS) operating below 1 GHz. WARC-92 allocated 3.45 MHz of primary spectrum to this service. Since that time, the United States has licensed one non-geostationary MSS system to operate in the U.S. in these new primary frequencies and has six pending system applications. Satellites from the first system have already been launched.

Experience with the use of the MSS bands below 1 GHz, as well as recent studies of the ITU-R that are reflected in the Report of the Conference Preparatory Meeting (CPM), indicate that several modifications could be made to existing MSS frequency allocations to facilitate their use. Proposals to facilitate the use of existing allocations for mobile-satellite services may be made pursuant to agenda item 2.1(a). Accordingly, the U.S. proposes to modify a number of footnotes to the 148-150.05 MHz band to improve coordination efforts in this band. In accordance with a suggestion from the Voluntary Group of Experts that allocations be made, where possible, to the broadest category of service, the U.S. further proposes to change the Land Mobile-Satellite allocation in the 149.9-150.05 MHz band to a more general Mobile-Satellite Service.

In addition to discussing the improvement of existing MSS allocations, the CPM Report states that additional spectrum will be necessary to meet the near-term requirements for MSS below 1 GHz. Because WRC-95 is empowered to make limited allocations to MSS pursuant to agenda item 3(d), if such allocations are necessary, the United States proposes to modify the international Table of Allocations to include 6.105 MHz of spectrum to be used by MSS, or associated feeder links. The bands suggested for allocation to MSS include 216-216.5 MHz (space-to-Earth) and 217.5-218 MHz (space-to-Earth), 399.9-400.05 MHz (Earth-to-space), 401-404 MHz ((space-to-Earth with the 401.2-401.7 MHz

segment allocated to MSS on a secondary basis), 455-456 MHz (Earth-to-space) and 459-460 MHz (Earth-to-space).

Article 8 (S5)

USA/ /1
NOC 599A
(S5.208A)

Reason:

The Report of the Conference Preparatory Meeting confirms that the pfd trigger level of $-125\text{dB}(\text{W}/\text{m}^2/4\text{kHz})$ for coordination with terrestrial services is appropriate at this time.

MHz
148-150.05

USA/ /2 MOD

Allocation to Services		
Region 1	Region 2	Region 3
148-149.9 FIXED MOBILE except aeronautical mobile (R) MOBILE-SATELLITE (Earth-to-space) MOD <u>599B</u> 608 MOD <u>608A</u> 608C	148-149.9 FIXED MOBILE MOBILE-SATELLITE (Earth-to-space) MOD <u>599B</u> 608 MOD <u>608A</u> 608C	
149.9 -150.05	RADIONAVIGATION-SATELLITE LAND MOBILE-SATELLITE (Earth-to-space) MOD <u>599B</u> MOD <u>609B</u> MOD <u>608B</u> 609 609A	

Reason:

To allow for maximum flexibility in system implementation, the land mobile-satellite allocation in the 149.9-150.05 MHz band is proposed for any mobile-satellite service. See also VGE Recommendations 1/7 and 1/8.

USA/ /3 MOD

599B WARC-92

(S5.209)

The use of the bands 137-138 MHz, ~~148-149.9 MHz, 150.05 MHz, 216-216.5 MHz, 217.5-218 MHz, 399.9-400.05 MHz, 400.15-401.404 MHz, 455-456 MHz and 459-460 MHz~~ by the mobile-satellite service and the band ~~149.9-150.05 MHz~~ by the land mobile-satellite service is limited to non-geostationary-satellite systems.

Reason:

Modification to footnote 599B is required to reflect the allocation to the mobile satellite service of the 149.9-150.05 MHz, 216-216.5, 217-217.5, 399.9-400.05 MHz, 455-456 MHz and 459-460 MHz bands.

USA/ /4 MOD

608A WARC-92

(S5.219)

The use of the band 148-149.9 MHz by the mobile-satellite service is subject to the application of the coordination and notification procedures set fourth in MOD Resolution 46 (~~WARC-92~~). The mobile-satellite service shall not constrain the development and use of fixed, mobile and space operation services in the band 148-149.9 MHz. Administrations using mobile earth stations in the mobile-satellite service shall ~~not produce power flux density in excess of -150 dB(W/m²/4kHz)~~ coordinate outside national boundaries through use of the coordination distance method in Recommendation ITU-R M. [Doc.8/46].

Reason:

Modification of RR 608A is required because the -150 dB(W/m²/4kHz) has proven to be operationally unusable. A coordination distance threshold is a more useful approach to facilitate coordination across national boundaries; this approach is supported in the report of the CPM.

USA/ /5 MOD
608B WARC-92

(S5.220)

The use of the bands 149.9-150.05 MHz and 399.9-400.05 MHz by the mobile-satellite service is subject to the application of the coordination and notification procedures set forth in MOD Resolution 46 ~~(WARC-92)~~. The ~~land~~ mobile-satellite service shall not constrain the development and use of the radionavigation-satellite service in the band 149.9-150.05 MHz and 399.9-400.05 MHz. ~~Land mobile earth stations of the land Mobile-satellite service shall not produce power flux density in excess of -150 dB(W/m²/4 kHz) outside national boundaries. Mobile earth stations in the mobile-satellite service shall coordinate outside of national boundaries through use of the coordination distance method in Recommendation ITU-R M. [Doc.8/46].~~

Reason:

Modification of RR 608B is required because the -150 dB(W/m²/4kHz) has proven to be operationally unusable. A coordination distance threshold is a more useful approach to facilitate coordination across national boundaries. This revision is supported in the report of the CPM. The removal of "land" in RR 608B reflects the proposed change in the allocation of the 149.9-150.05 MHz band to the mobile satellite service. Further modification of RR608B is also required to reflect the proposed allocation of the 399.9-400.05 MHz band to the mobile-satellite service.

USA/ /6 MOD
609B WARC-92

(S5.224)

In the bands 149.9-150.05 MHz and 399.9-400.05 MHz the allocation to the ~~land~~ mobile-satellite shall be on a secondary basis until 1 January 1997.

Reason:

The removal of "land" in RR 609B reflects the change proposed in the allocation table to the mobile-satellite service. Further modification to RR 609B is required to reflect the

proposed allocation of the 399.9-400.05 MHz band to the mobile-satellite service.

MHz
216 -216.5

USA/ /7 MOD

Allocation to Services		
Region 1	Region 2	Region 3
216-216.5 BROADCASTING <u>MOBILE-SATELLITE (space-to-Earth) MOD 599B</u>	216-216.5 FIXED MARITIME MOBILE <u>MOBILE-SATELLITE (space-to-Earth) MOD 599B</u> Radiolocation 627	216-216.5 FIXED MOBILE BROADCASTING <u>MOBILE-SATELLITE (space-to-Earth) MOD 599B</u>
621 623 628 629	627A	626

Reason:

To make available additional spectrum for MSS systems, in accordance with the Report of the CPM which notes that 7-10 MHz of additional spectrum will be required for MSS below 1 GHz.

MHz
217.5 -218

USA/ /8 MOD

Allocation to Services		
Region 1	Region 2	Region 3
217.5-218 BROADCASTING <u>MOBILE-SATELLITE</u> <u>(space-to-Earth)</u> MOD 599B	217.5-218 FIXED MARITIME MOBILE <u>MOBILE-SATELLITE</u> <u>(space-to-Earth)</u> MOD 599B Radiolocation 627	217.5-218 FIXED MOBILE BROADCASTING <u>MOBILE-SATELLITE</u> <u>(space-to-Earth)</u> MOD 599B
621 623 628 629	627A	626

Reason:

To make available additional spectrum for MSS systems, in accordance with the Report of the CPM which notes that 7-10 MHz of additional spectrum will be required for MSS below 1 GHz.

MHz
399.9-400.05

USA/ /9 MOD

Allocation to Services		
Region 1 MHz	Region 2 MHz	Region 3 MHz
399.9-400.05 RADIONAVIGATION-SATELLITE		
<u>MOBILE-SATELLITE (Earth-to-space)</u> MOD <u>599B</u> MOD <u>609B</u>		
MOD <u>608B</u> 609 645B		

Reason:

To provide spectrum for non-geostationary mobile-satellite services. See also VGE Recommendations 1/7 and 1/8. RR MOD 609B is included to protect existing radionavigation satellite operations until 1 January 1997.

MHz
335.4-402

USA/ /10 MOD

Allocation to Services		
Region 1	Region 2	Region 3
401-401.2	METEOROLOGICAL AIDS SPACE OPERATION (space-to-Earth) <u>MOBILE-SATELLITE</u> (space-to-Earth) MOD 599B <u>METEOROLOGICAL-SATELLITE (Earth-to-space)</u> <u>EARTH EXPLORATION-SATELLITE (Earth-to-space)</u> Earth Exploration-Satellite (Earth-to-space) Fixed Meteorological-Satellite (Earth-to-space) Mobile except aeronautical mobile 648A	
401.2-401.7	METEOROLOGICAL AIDS SPACE OPERATION (space-to-Earth) <u>Mobile-Satellite</u> (space-to-Earth) MOD 599B <u>METEOROLOGICAL-SATELLITE (Earth-to-space)</u> <u>EARTH EXPLORATION-SATELLITE (Earth-to-space)</u> Earth Exploration-Satellite (Earth-to-space) Fixed Meteorological-Satellite (Earth-to-space) Mobile except aeronautical mobile 648A	